The Mining Journal

Established 1835

Railway & Commercial Gazette

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The Koh-i-noor

is the oldest of famous diamonds. It was found some 5,000 years ago on the Godavari river in India. It has passed through the hands of many princes, some of whom suffered torture from victorious rivals who sought the stone. Its last Indian possessor was Ranjit-Singh, the Lion of the Punjab. To-day the Koh-i-noor is part of the Queen's crown. One of many sayings about the Koh-i-noor is that it has never brought bad luck to a woman.

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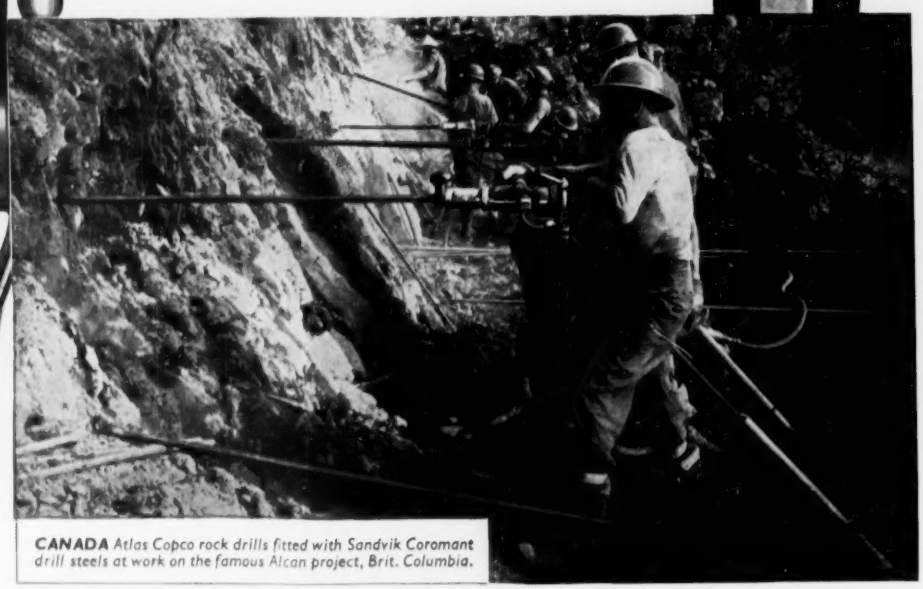
THIS

FITTED TO THIS

STARTED A NOISY REVOLUTION

This was no quiet affair for it concerned—and radically altered—existing drilling practice. It started with the introduction of a new drill and a special drill steel developed to work together. This revolutionary drilling unit is the Atlas Copco light rock drill and the Sandvik Coromant tungsten-carbide-tipped drill steel. The measure of this drilling unit's success has been its rapid, wide-scale adoption throughout the drilling world—accompanied, wherever it is in use, by a change to *faster, smoother, far more economical methods.*

MORE DRILLS AT WORK. A striking advantage of this unit is the compactness and lightness of the Atlas Copco rock drill. This has practically swept away the two-man, bar-rigged drifter and with it, faces cluttered with unproductive crews and bulky equipment. *Atlas Copco rock drills are one-man machines.* That means *more* machines engaged on *actual* drilling operations at one and the same time.



CANADA *Atlas Copco rock drills fitted with Sandvik Coromant drill steels at work on the famous Alcan project, Brit. Columbia.*

DEVELOPED TOGETHER. The Atlas Copco light rock drill is only half the story of this drilling unit. From the earliest research and experimental stages, its development has been tied with that of the Sandvik Coromant tungsten-carbide-tipped drill steel. Work on both has always been towards a combination rock drill and drill steel (a drill and steel produced separately could never be as well balanced or give equivalently high performances), and has been the basis of this drilling unit's outstanding triumph.

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BRAZIL *This circular discharge tunnel for the Paulo Afonso project was drilled by Atlas Copco rock drills fitted with Sandvik Coromant drill steels*

SWEDEN *An Atlas Copco rock drill — a one-man machine — in operation down the Persberg Mine. It is fitted with a Sandvik Coromant drill steel.*

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NOTES AND COMMENTS

The Changing Outlook for British Steel

Superficially there is not much evidence of a dramatic change in the outlook for British steel. From the high peak of ingot production which reached the record weekly average of 401,600 tons in May there was a decline of 37,000 tons per week in June, almost wholly attributable to the past rail strike, the consequences of which have not yet been entirely overcome. The Iron and Steel Board is now doubtful about attaining the target figure of 19,500,000 tons for the year, although in the first half of 1955 more than 10,000,000 tons were produced. In short, the Board, with a full knowledge of the facts, anticipates a drop of 500,000 tons in the output of steel during the second half of this year.

One of the most intractable problems is the assembly of the vast quantities of raw materials required to sustain iron and steel production at present levels. There is no lack of ore. Year by year Canada is becoming an increasingly important exporter and although the bulk of the supplies from the rapidly developing Quebec-Labrador deposits are consigned to the U.S., as also are the bulk of the Venezuelan ores, a few cargoes of Canadian ores have also been shipped to British ports.

Not supplies, but shipping facilities, are lacking. So many ships are engaged on the import of coal to Britain that cargo space for ore shipments has been scarce. Shipping programmes have also been dislocated by the rail and dock strikes, and the consequent curtailment of ore imports during the peak summer period has prevented the build up of stocks and may involve some check to the expansion of pig iron production in the next few months when four mammoth new blast furnaces with a combined capacity of 1,000,000 tons of pig iron per annum are due to come into operation.

These frustrations are all the more lamentable since the British metal using industries are even more desperately in need of supplies than they have ever been since the end of the war. Deliveries of finished steel products to U.K. consumers in the first five months of this year totalled 5,591,000 tons, an increase over last year's figures of about 9 per cent, and there is a good prospect of an overall rise of 10 per cent in the second half of the year. But we are now heavily dependent on foreign supplies. Imports of finished material have increased from 5,900 tons to 15,100 tons a week and there has also been an increase in the weekly average of semi-finished steel imports from 3,900 to 6,900 tons.

The enormous weight of steel required by the engineering, ship building and motor industries has also necessitated some curtailment of exports and these two well defined trends—the expansion of imports and the limitation of exports—are at least a contributory cause of the widening of Britain's trade gap.

Markets lost to foreign competitors are not easily regained, and for that reason the big consumers of British steel view with some disquiet the possibility of another rise in prices. The fact that British steel has been and is still relatively cheap has been a material factor in the success of the engineering industry in attaining expansion of its export trade.

During the past few weeks there has been a further advance in both German and American steel prices. The ten-hour strike of 600,000 steel workers in the U.S. on June 30 was ended by the concession of a 15 c. per hour rise and an advance of $7½ in the price of steel.

It is feared that the resistance of British steel to the forces of inflation cannot be much longer maintained. Probably influenced by the high level of profits revealed in the recently published balance sheets of some of the biggest steel companies, the Iron and Steel Board left the industry to carry the whole of the burden of the 7½ per cent rise in railway rates which came into force at the beginning of June. Yet an 18 per cent rise in coal prices, which was authorized on Monday, July 18, was a horse of another colour. Steel makers maintain that an advance which may increase their costs of production by nearly £1 per ton is too steep to be carried without passing some of the burden to the consumer and an all round revision of the maximum controlled prices of iron and steel is now awaited.

Steady technical progress has enabled the industry to effect substantial economies in the use of coal. Since 1920 coal consumption per ton of pig iron produced has been reduced by 12 cwt. The three main factors which have contributed to this reduction have been the increased size of blast furnaces, improvement in the quality of coke made in the new ovens, and improved methods of iron ore preparation. Other economies have been achieved in the steel works by the use of producer gas and oil fuel. Most

of the open hearth furnaces recently constructed, or in course of construction, are designed for the inclusive use of liquid fuel and it may well be that the transition will be accelerated by the now prohibitive cost of coal.

The United States Bureau of Mines in 1956

It has recently been disclosed that funds totalling $18,863,000 have been made available to the U.S. Bureau of Mines for the financial year 1956. These funds will enable the Bureau to embark on new research programmes in addition to its traditional tasks of promoting efficient and economical mining practices within the American mining industry. It must be concluded that the Bureau's work is regarded with marked favour in high places, as the appropriation approved by Congress and signed into law by President Eisenhower is exactly that requested by the Department of the Interior.

Of the total appropriation, the Bureau will use $6,603,870 for its programmes on solid, liquid and gaseous fuels, $300,000 for controlling fires in inactive coal deposits, $5,989,130 for studies on metallic and nonmetallic minerals, $5,000,000 for health, safety, and coal-mine inspection programmes, and $970,000 for general administrative expenses.

Utilizing facilities at the new Rare and Precious Metals Experimental Station in Nevada, the Bureau plans in 1956 to increase efforts to separate the rare earth metals. The potentials of these experiments are indicated on page 102 of this issue. A further necessary undertaking that will be made possible by the new appropriation will be a study of modern ore mining methods, as developments during recent years have rendered the classic references on mining obsolete and there is a need for the compilation of data on methods and costs that will assist the industry in coping with current problems. Other investigations will be directed towards the effective exploitation of mineral resources and the eventual commercial development of domestic mineral deposits now regarded as marginal or sub-marginal. Studies of the mechanics of block caving will be accelerated.

Important aspects of the programme concern such ferro-alloy materials as manganese, tungsten, molybdenum and vanadium, the utilization of low grade domestic materials as substitutes for imported bauxite in aluminium production and a study of the alloys of magnesium. The Bureau is giving increasing attention to improved and new methods of recovering greater amounts of metals in purer and more useful forms.

Field Surveys in Canada

A total of seventy-three surveying parties are being placed in the field this season by the Surveys and Mapping branch of the Canadian Department of Mines. Their operations are taking place in the far north of the Dominion.

Some twenty parties are working in the Yukon, Northwest Territories and the Arctic Islands. They will establish the framework for the mapping of Canada's northern areas by determining the latitudes, longitudes and heights above sea level of selected points, and will obtain all the topographical data needed for the production of the base maps necessary for resources development and other purposes.

Eighteen of the seventy-three parties are from the Geodetic Survey of Canada, twenty-five from the Topographical Survey, twelve from Legal Surveys and eighteen from the Canadian Hydrographic Service.

The programme includes two helicopter projects and a radar altimetry survey. The helicopter projects will be carried out by the Topographical Survey over areas totalling 600,000 square miles in New Quebec-Labrador and along the lower Mackenzie River in Northwest Territories.

The Rhodesias

(From Our Own Correspondent)

Salisbury, July 14.

In recent years the accent of industrial advancement in Southern Rhodesia has been increasingly placed on mineral production. One of the most interesting developments since the war has been the exploitation of lithium deposits near Fort Victoria. Production has increased from under 20,000 tons in 1953 to over 54,000 tons last year. Most of the lithium ores up to now have been exported to the United States.

The deposits at Fort Victoria are said to be the largest known of high grade lithium orebodies in the world. Several producers are now operating there, and Bikita Minerals (Pvt.) Ltd., are constructing a new plant for screening and crushing the ore. Expenditure at Bikita Minerals has, thus far, been £1,000,000, not including the new plant, while capital expenditure at the neighbouring plant of George Nolan Ltd., is estimated at about £180,000 with another £60,000 expected to be added.

FACETS OF CHROME PRODUCTION

Improvements in the ability of Rhodesian Railways to handle the Central African Federation's mineral traffic have been noted with approval in the Federation. Yet the position is that demands for new engines and rolling stock continue to outstrip supplies. Indeed, United Kingdom delivery dates for essential equipment show little sign of improvement, and the formal handing over of one of a large order of diesel-electric locomotives during July was marred by the fact that delivery was eight months late.

In March, for the first time in recent years, Southern Rhodesia's industries received all their needs in the way of coal but since then the railways have once more been unable fully to keep pace with the volume of coal production at Wankie, the Federation's sole source of supply. This is all the more disappointing since the output of coal from Wankie has increased considerably since the colliery was taken over by the Anglo American Corporation.

Rhodesian chrome producers, who have had painful experience of the railways in the past, are particularly concerned. So far this year chrome tonnages carried are considerably less than during the same period last year, and it is becoming increasing necessary that more chrome should be smelted in the Federation.

Captain R. G. Arnot, General Manager of Rhodesia Alloys Ltd. said this month that the availability of hydro-electric power from the Kariba power scheme must lead to an increase in the amount of ore smelting done locally. At present the bulk of world chrome smelting is done in Norway, Sweden, and in America, notwithstanding that the Federation is one of the world's leading producers.

PROSPECTING IN THE NORTH

Prospecting in Northern Rhodesia is being generally accelerated. The latest development is the formation of a new company, Chartered Exploration Ltd., with an authorized capital of £1,000,000 to undertake geological work to start under the technical direction of Anglo American Corporation of South Africa Ltd.

One of the areas concerned lies in the Luangwa Valley, but it is unlikely that mining operations will be practicable there, at least for some years, because of the lack of communications and the generally unfriendly nature of the terrain and climate. This move leaves just on 50,000 square miles of ground in Northern Rhodesia still open to ordinary prospectors.

Developments in the Coal Industry

In the four-year period 1955-59 countries of the European Coal and Steel Community are preparing to increase expenditure and output despite the fact that rising industrial productivity is making bigger demands for coal than can be met. In the following article our Coal Correspondent discusses the latest developments in the industry in Europe and points out that improved safety statistics were recorded in United Kingdom pits during 1954.

Last month saw the election of a new President for the European Coal and Steel Community. Former French Premier, René Mayer was appointed by the Council of Ministers in succession to Jean Monnet who resigned last autumn in protest against the incursion of nationalism into the Community. M. Monnet, who first proposed the coal and steel pool and did much of the work to bring the project to fruition, had a last minute change of heart and decided to seek re-election after all.

In a letter to the participating Governments shortly before the meeting of the Council of Ministers he indicated his willingness to reverse his original decision not to stand, giving as the reason for his change of attitude the positive proposals for European integration made recently by the Benelux countries. M. Monnet did not, however, receive the backing of the French Premier, who successfully proposed M. Mayer.

After the election the Council of Ministers heard the Netherlands Foreign Minister call for a drastic increase in the Community's powers. Backed by the Benelux countries the Dutchman proposed: (1) a common market for all European products; (2) integration of European road and rail services; (3) a European pool for the development of atomic power.

These far reaching proposals did not, however, receive unmitigated approval and whilst agreeing that the Benelux suggestions were excellent the Council of Ministers would not accept the calling of an immediate conference to draft the necessary treaties to give life to supranational pools and other bodies for the control of an integrated European economy. The French wanted to go slow, and the Germans—who used to be so ardently supranational when they had no sovereignty to lose—seemed reluctant to surrender any of their newly won national independence. The outcome of the Benelux proposals was that the committee is to be set up to study the suggestions over the next few months and then report back in October, 1955. Countries outside the Community will probably be invited to participate in the work of this committee, particularly Great Britain.

INCREASED OUTPUT CAPACITY

Meanwhile, capital investment planned and in progress in the coal industries of the E.C.S.C. provides for an increase in output capacity of 31,000,000 tons. For the four-year period 1955-59 it is proposed to spend $1,400,000,000, this bringing the total investments since the birth of the Community to $2,540,000,000. Despite the projected increase in output of coal, the Community still must face up to the fact that rising industrial productivity is making—and will continue to make—bigger demands for coal than can be met. At the present time the fall in pithead stocks of coal and coke is causing anxiety in Germany. These stocks have fallen to a new low level of 260,000 tons. Consumption of coal by West German industry is running some 14 per cent higher than last year whilst output is up by only 3 per cent. In addition to greatly increased imports from the U.S. Western Germany has decided to buy coal from the Soviet Union. This coal is cheaper than that bought from America and although only some 10,000 tons have been imported it seems likely that more substantial orders will be placed with Russia.

Despite the precarious position of Britain's nationalized coal industry the General Secretary of the National Union of Mineworkers, when speaking at a miners' rally recently, declared that the next objective is the restoration of the seven-hour working day. This utterance, coming at a time when output is lagging almost 3,000,000 tons behind last year's uninspiring total, might appear to be somewhat contradictory to the union policy of encouraging overtime in the form of Saturday working. However, if the seven-hour shift is introduced the additional half hour now worked could, of course, be classed as overtime and be paid for accordingly. The net result would be a substantial rise in wages for the same number of working hours.

IMPROVED U.K. SAFETY STANDARDS

Even if output records are not being broken it is reassuring to learn that the U.K. is setting new safety standards. The annual rate of deaths and serious accidents were the lowest on record, according to the statistical digest for 1954 recently issued by the Ministry of Fuel and Power. The number of deaths at 371 was 21 fewer than in the previous year and was equivalent to an all-time low of 0.5 per 1,000 employees. The figure for serious accidents was also a record at 2.5 per 1,000 men employed.

Whilst on the topic of safety in mines a recent development in the fighting of fires underground is worthy of mention.[1] Recent experiments by the British Safety in Mines Research Establishment suggest that a technique of fire fighting underground may be furnished by the generation of air-water foam over the whole X section of a roadway and by making use of the normal ventilation to push the resultant plug of foam into the fire zone. The foam is generated by spraying water containing a wetting agent, and a foam stabilizer, on to the intake side of a textile net stretched completely across the roadway. Bubbles are blown on the side of the net by the ventilation current and so form a honeycomb which extends across the roadway and is gradually built up and pushed along the roadway by the air stream. Large scale experiments have shown that foam plugs 130 yards in length can be produced. If the water content of such a foam were one-thousandth of its air content by volume, then on passing into the fire zone, the vaporization of this water will reduce the oxygen content by some 50 per cent and so blanket any fire. In addition the foam would have a cooling action and this, combined with the oxygen excluding and diluting action of the foam plug, suggests that here is a promising method of tackling extensive roadway fires underground.

From the Far East comes news that the Japanese Government has approved a draft plan for the reorganization of the coal mining industry. The main points in the plan are the setting up of an organization to rationalize the industry and mines which are unproductive will be taken over by this organization. The Government will fix the price of coal if necessary and no mines will be opened without Government authority. In an effort to lower the cost of coal the Japanese Development Bank will reduce its rates on loans to coal mining companies from 8.6 to 5.5 per cent.

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(1) *Recent Experiments with Foam Plugs in Ventilated Roadways*, by H. S. Eisner and P. B. Smith, S.M.R.(A.)B. Paper No. 66.

Trends in the Use of Rare Metals

Metallurgical research and development over the past quarter century and particularly during the last decade have focused attention on many relatively unfamiliar elements. The stimulation of a world war, the international interest in atomic power, and the expanding field of electronics, contributed to this interest, as a result of which the rare metallic elements have taken on a new significance. The following article describes the rare metallic elements and their applications in modern usage. The article is condensed from a paper presented at the April meeting of the North-West Section of the A.I.M.E. in Spokane, United States, by A. J. Kauffman Jr., chief of the Division of Mineral Industries, U.S. Bureau of Mines.

It has been estimated that only eight elements are present in the earth's crust in quantities greater than one per cent. These elements—oxygen, silicon, aluminium, iron, calcium, sodium, potassium, and magnesium—account for almost 99 per cent of the total. This means that copper, lead, and zinc plus all the other well known as well as unfamiliar elements account for about one per cent of the earth's crust.

Actually there are 14 members of the rare earth group. However, yttrium and thorium, because of similar chemical properties sometimes are included.

Percentage content of certain rare metals in earth's crust

Rare Metals		*Rare Earths*			
Material	%	*Material*	%	*Material*	%
Zirconium	0.0220	Cerium	0.0046	Ytterbium	0.0003
Columbium	0.0024	Yttrium	0.0028	Erbium	0.0003
Thorium	0.0012	Neodymium	0.0024	Lutecium	0.0001
Hafnium	0.0005	Lanthanum	0.0018	Holmium	0.0001
Uranium	0.0004	Samarium	0.0007	Terbium	0.0001
Tantalum	0.0002	Gadolinium	0.0006	Europium	0.0001
Rare Earths	0.0151	Praseody-mium	0.0006	Thulium	0.0001
Total (metals)	0.0418	Dysprosium	0.0005	Total (Rare Earths)	0.0151

THE RARE METALS GROUP

The group of elements designated as rare represents only 0.0418 per cent of the total. Titanium, estimated at about 0.44 per cent, is not included in this figure. Zirconium, the most abundant of the group, is present in the earth's crust in higher concentrations than chromium, and greater than copper, lead and zinc combined.

As a group, the rare earth metals are equal in concentration to vanadium and zinc, and greater than nickel, tungsten, and tin. Columbium and tantalum combined are found in concentrations greater than cobalt, lead, molybdenum, and arsenic.

Hafnium and uranium, present in the crust of the earth in about equal quantities, are found in concentrations greater than 4 x antimony, 8 x mercury, 40 x silver, and 800 x gold and platinum. Thorium is about three times more plentiful than uranium.

These rare metals are found combined in monazite, ilmenite, zircon, and columbium-tantalum-bearing minerals and will be considered as potentially commercial constituents of the alluvial deposits. Monazite, a thorium-bearing phosphate of the rare earth elements, is found disseminated widely as an accessory mineral in both igneous and metamorphic rocks and, as a consequence, occurs as a detrital product resulting from the weathering of these rocks.

Ilmenite, the most abundant heavy constituent of these alluvial sands, is a titanium-bearing mineral. The composition of ilmenite varies considerably since titanium and iron oxide form a series of compounds. Usually, however, it is expressed as a simple iron titanate.

Zircon, an orthosilicate, is the most widely distributed and most abundant zircon-bearing mineral. It occurs as an accessory mineral in almost all types of plutonic and volcanic rocks, but most commonly in pegmatites and granites. Its high specific gravity and hardness enable it to resist transporting agencies and abrasive action so that it is found in alluvial deposits relatively close to the source.

Pegmatites also are the source of columbium-tantalum minerals. The most important columbium-tantalum mineral is a ferrous columbate-tantalate. Other columbium-tantalum-bearing minerals which also contain titanium, thorium, uranium, and some of the rare earth elements, are euxenite, fergusonite, and samarskite.

Garnet, magnetite, and gold also are present in varying quantities in these alluvial sands.

Research and development programmes directed to the production and application of the new metals are ever-increasing. Processing techniques have been developed employing high vacuum systems and noble-gas atmospheres. These improvements either prevent contamination or at least help to keep the impurity level low. The true physical properties of titanium and zirconium, for example, were not realized until a few hundredths per cent of oxygen or nitrogen had been removed, revealing that the metals, long thought to be brittle and of little possible use, actually were malleable. The rare earths, long used as a mixture because of similar chemical properties which defied separation, now are finding new use in separated form due to new techniques, especially of ion exchange and liquid-liquid extraction.

Titanium usually is considered a light metal and not in the rare category, but is the most abundant constituent of the black sands. Like zircon, most of the ilmenite consumption is for non-metallic purposes.

Zirconium and hafnium can be considered together. The two metals occur intimately associated in nature and because of their similar chemical behaviour have presented separation problems. It became apparent during the early stages of the research directed toward using zirconium metal for nuclear reactors that for such applications zirconium would have to be virtually free of hafnium. A suitable method was developed and in 1951 the U.S. Bureau of Mines began producing zirconium and hafnium in quantity.

Hafnium is ductile and corrosion resistant but not as favourably as zirconium. Opposed to zirconium, it has a very high absorption cross section for thermal neutrons. Potentially zirconium can be used in applications requiring corrosion resistance, ductility, and strength. Hafnium's high absorption cross section suggests use as radiation shielding material. The oxide and carbide, because of their extreme melting points, are of current interest in the development of nuclear reactors.

COLUMBIUM AND TANTALUM

The United States depends upon foreign sources almost entirely for its supply of columbium and tantalum. Beneficial effects result from additions of columbium in the form of ferrocolumbium (40-50 per cent Cb) or ferrocolumbium-tantalum (60 per cent Cb+Ta) to chromium steels because the carbon in the alloy preferentially combines with the columbium instead of the chromium, thereby making it possible for the crystal boundaries to retain their chromium content, thus preventing intergranular and intercrystalline corrosion. As a result, air hardening is reduced

and toughness, weldability, ductility, and corrosion resistance are increased.

Modern usage of tantalum has been in the electronics field where it is used as anode and grid material for transmitting tubes which operate at extremely high temperatures and high voltage.

SEPARATED RARE EARTHS

The use of separated rare earths in compound form is increasing steadily. Cerium oxide is used in the manufacture of special container glass to prevent passage of ultraviolet light, and a recent application has been in the manufacture of glass for windows in radiation shields. Lanthanum oxide is used to make a special non-corroding silica-free glass of high refractive index for aerial photographic lenses and other optical instruments.

Neodymium and praseodymium have very strong absorption bands in the yellow region of the spectrum. A mixture of these in oxide form is used in the manufacture of special glass for glass blower's and welder's goggles. Europium and samarium salts are used as activators in red and infrared phosphors. Lanthanum ammonium nitrate and gadolinium oxide are used for classified atomic energy applications.

There are several additional potentially important applications of the rare earths. The hot-workability of austenitic chromium-nickel and high alloyed stainless steel is improved by additions of the rare earths. Additions of the rare earths in this form of misch-metal to cast iron act as powerful oxidizers and aid in the removal of slag from the molten metal. Additions to malleable iron act as a carbide stabilizer.

Because of the development and utilization of the large bastnaesite deposit in California, substitution for the rare earths from the point of necessity is rather remote. Substitute materials for the rare earths, however, are available at less cost but usually are not as satisfactory.

U.S. PRODUCTION AND CONSUMPTION

Ilmenite. Since 1950 annual domestic ilmenite production has averaged about 512,000 tons and consumption approximately 693,000 tons. During the same period, imports of ilmenite have averaged 219,000 tons.

Zircon. Since 1950 imports of zircon have averaged 22,000 tons.

Columbium and tantalum. The average domestic production for 1950 and 1951, measured as mine shipments, was about 1,000 lb. Consumption was estimated in 1952 to be between 300 and 400 tons. Imports, 1950 and 1952, have averaged 850 tons of columbite and 150 tons tantalite.

Rare earths. Production statistics for monazite and consumption data for the rare earth metals are classified.

Production of rare earth metals from California bastnaesite, received increased attention during 1954 for use in the iron and steel industry. Improvement of mining and milling methods by industry made it possible to reduce the price of rare earth oxides from this source from $1.50 to $1 per lb. and further reductions appeared likely during 1955.

Thorium. The annual average 1950-52 has been about 44,000 lb. This value, however, may be confusing since there has been a steady decline in consumption since 1950.

DEEP MINING—III

Problems Associated with Ultra-deep Mining Operations on the Central Witwatersrand

In *The Mining Journal* of July 8 and 15, the major problems associated with deep-level mining on the Central Witwatersrand, namely those of heat and rock bursts, were discussed in two previous instalments of the following article. The final portion of the article appearing herewith, discusses other problems of deep-level mining operations in mines of the Central Witwatersrand, and concludes with a précis of the research activities being undertaken in an attempt to erase these difficulties. This series is condensed from a paper entitled *The Exploitation of the Ultra-Deep Areas of the Gold Mines of the Central Witwatersrand,* presented by F. G. Hill, a consulting engineer for Central Mining and Investment Corporation Ltd., at the Centenary Congress of the Société de l'Industrie Minérale held in Saint-Etienne from June 16 to June 18 and in Paris from June 18 to July 3, 1955. It is of interest to note that the forecast has been made that, providing the ore being mined is sufficiently rich, the deepest point eventually reached in mining operations on the Central Witwatersrand may be in the order of 12,000 ft.

In a sense, the removal of shaft pillars is a facet of the rock pressure problem, for the difficulties encountered in removing shaft pillars are linked with the high stresses that have built up in the solid pillar. The removal of reef over incline shafts as the initial step in stoping virgin areas is established practice but the initial removal of reef around vertical shafts on the other hand, is not generally practised. Yet on the one Central Rand mine where this was done the operation was a great success.

VERTICAL SHAFT PRACTICE

The common practice with vertical shafts is to leave around the shaft a large pillar of intact reef measuring some 500 ft. or more in all directions from the shaft. The difficulties of finally removing a pillar in ultra-deep areas are so great, however, that the author believes that the practice in regard to vertical shafts will ultimately follow the incline shaft pattern, that is, the first ore to be stoped will be that adjoining the shaft. In this way the zones of high stress will be removed from the most important sections of the mine, namely, the shaft areas where large underground excavations such as hoist and pump chambers are usually located.

The problem of high water pressures is one that has so far been successfully met. Cementation practice has been described on several previous occasions in *The Mining Journal.*

THE WATER HAZARD

The presence of water in the strata overlying an ultra-deep level mine is a hazard in regard to which the manager must be on constant guard because of the high pressure of the water and the need for keeping the inflow under control. On the Central Witwatersrand the rock strata above the mines contain negligible quantities of water, so that while the possibility exists that water at high pressure may be encountered, as at Durban Roodepoort Deep, this particular ultra-deep problem is not for the Central Rand Mines the burden that it is for the Far West Rand mines.

Ultra-deep mining also poses problems to the mechanical engineer, mainly in regard to hoisting and pumping. In both spheres the demand has been for large powerful units,

and the mechanical engineers have successfully designed machinery to meet the demand.

HOIST SPECIFICATIONS

Specifications of the hoists used for a typical ultra-deep-level shaft system, namely the E.R.P.M. Ltd. Angelo Section, are .

Central Vertical Shaft : The four winders installed are two hoists, geared Ward Leonard Scherbius flywheel winders, each having two bi-cylindro-conical drums, both clutched. Drums are 12 ft. dia. on the small barrel and 36 ft. dia. on the large barrel. The load is 16,000 lb. of rock at 3,000 f.p.m. from 5,950 ft. vertical using 1⅛ in. dia. rope; h.p. r.m.s./peak = 2766/4725.

One hoist, geared three-phase winder with two 12 ft. dia. by 4 ft. wide cylindrical drums, both clutched. The load is 15 men in cage weighing 5,355 lb. from 5,980 ft. vertical at 2,000 f.p.m. using 1⅛ in. dia. rope. Motor rating h.p. r.m.s. = 1100.

One hoist, geared Ward Leonard winder with a single 12 ft. dia. by 5 ft. wide cylindrical drum. The load is 7,000 lb. of material at 1,000 f.p.m. from 5,798 ft. vertical using 1⅛ in. dia. rope. Motor rating h.p., r.m.s. = 932.

Central Sub-Vertical Shaft : The two winders to be installed are two hoists, geared three-phase winders each having two 14 ft. dia. by 4 ft. 6 in. wide cylindrical drums, both clutched. The winders, man and rock, are identical and were designed to pull 20,000 lb. of rock at 2,000 f.p.m. from 2,600 ft. vertical using 1¼ in. dia. rope. Designed h.p. r.m.s./peak = 2370/4090.

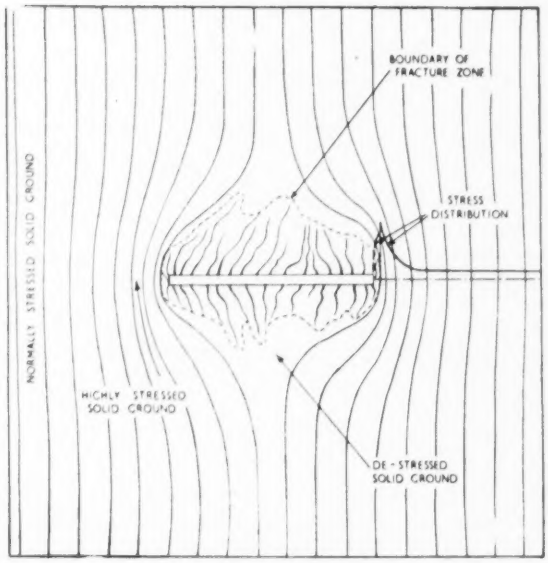
The main pumping system on the E.R.P.M. Ltd. consists of a series of pump stations situated at the Hercules Section on 14 level, 28 level, 50 level and 58 level, thus :—

Level	*Static Head (000 ft.)*	*Type of Pump*	*Nominal Capacity (000 gal. p. hr.)*
14	2.1	3 Units, Low and High Pressure Escher Wyss—Two 600 h.p. motors per unit ...	60
		1 Unit, Low and High Pressure Sulzer—Two 300 h.p. motors	30
25	3.7	1 Unit, G. and K. Mud Plunger, 6 in. x 18 in.—285 h.p. motor	12
28	2.1	3 Units, Low and High Pressure Escher Wyss—Two 600 h.p. motors per unit ...	60
		1 Unit, Low and High Pressure Sulzer—Two 300 h.p. motors	30
50	3.1	5 Units, Harland II Stage Pumps—Two 600 h.p. motors in Tandem per unit ...	45
	3.5	1 Unit, G. and K. Mud, Plunger 6 in. x 18 in.—285 h.p. motor ...	12
58	1.0	2 Units, Single Ended Sulzer—600 h.p. per unit	60
		2 Units, Single Ended Mud Sulzer—300 h.p. per unit ...	30

The above statistics give an adequate description of the Hercules pumping system.

RESEARCH ON MINING PROBLEMS

One of the means of ensuring satisfactory working conditions is to have large volumes of air circulating underground. For some years past research has been done on means of decreasing the resistance in shafts, as a result of which the much-used timbered rectangular shaft has fallen completely out of favour. The new rectangular shafts in the Orange Free State have steel dividers and no wall plates. Dividers are now being spaced a vertical distance apart of 10 to 15 ft. instead of the customary 6-7½ ft. spacing in timbered shafts. More recently large circular shafts have become popular, the largest being 26 ft. in dia. Research is actively in progress also to determine the effect of stream-lining shaft supports, so that still larger volumes may be delivered for the same ventilating pressure.



Conditions of ground and stress pattern around a stoping excavation

On the physiological side labour will be carefully studied in relation to heat, and the programme includes a study of production per unit of energy expended in various underground tasks, and the influence thereon of various environmental conditions, as well as methods of assessing capacity for work of individual labourers and the influence of rest pauses and feeding during work.

IMPORTANCE OF ROCK BURSTS

A great deal of investigation into the problem of rock bursts has been and is being done. The theory at present accepted is that a zone of fractured ground forms around every deep-level underground excavation. The shape of the fractured zone may be akin to that illustrated, but much work has still to be done to determine the shape of this zone. The stresses at the abutment of an excavation are considered to arise from the weight of most of the intradosal ground resting on the abutment, and the high stress in the solid ground ahead of the abutment due to the concentration of stress at this point. No suggestion is made that the intensities of stress are correctly depicted in the illustration above.

Records show that when a remnant abutment reaches a size of 200 sq. fathoms or less, the danger from further bursts is very small. The remnant has in fact become de-stressed and is in a relatively safe condition. Experience also shows that when an acute peak abutment bursts, the stope at the tip of the peak is less often and less severely affected than the stope at a distance of 50 ft. to 150 ft. from the tip. There is thus evidence to show that the tip of the peak, like a remnant, has been de-stressed.

The thought therefore arises that if a stope face can be de-stressed, possibly by the blasting of long holes drilled straight into the face, a cushion of de-stressed "dead" ground may be created between the stope face and the zone of solid, highly stressed ground. Investigations on these lines are proceeding.

Electronic Concentration of Low Grade Uranium Ores

The Lapointe Picker method of concentrating uranium ore by the electronic selection of radioactive pieces passing under the detector on a conveyor belt was first developed in 1947 and applied to certain pitchblende ores of relatively high grade. During 1954 the concentration of disseminated low grade urnanium ore was attempted and experiments were conducted with a modified Lapointe Picker. The following article describing these experiments, is condensed from *Technical Paper No. 10*, by A. H. Bettens and C. M. Lapointe of the Radioactivity Division, Mines Branch, Canadian Department of Mines and Technical Surveys, the publishing body.

A series of tests was performed on two ores from the Beaverlodge area, Saskatchewan. The material from one mine (Ore A) was tested in Ottawa, and that from the other mine (Ore B) at Eldorado, Saskatchewan. The purposes of these tests was to establish the applicability of the Lapointe Picker to low-grade ores and to find an optimum setting of the unit for maximum benefication, i.e., maximum per cent weight rejected at minimum loss of U_3O_8.

To achieve the required sensitivity a scintillation detector with a 1½ in. sodium iodide crystal was chosen and placed under the conveyor belt. This means that a gamma-ray detector was employed in this case and that the bulk of each piece of ore was relatively close to the detector.

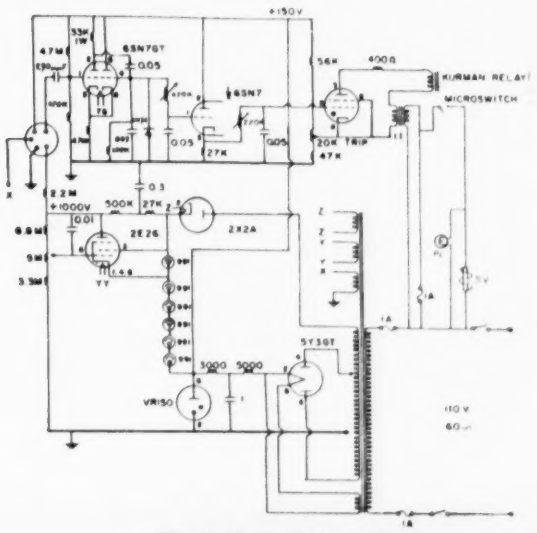
A summary of the results indicates that for +1½ in. mine ore the following can be expected :

Calculated heads	0.045-0.08% U_3O_8
Recovery	75-80%
Weight rejected	70-75%
Grade of concentrate ...	0.15-0.22% U_3O_8
Grade of rejects	0.01-0.02% U_3O_8

Tests on Ore A in Ottawa proved that, for +1½ in. ore, the scintillation unit was more sensitive and gave better overall results than the Geiger units, so only the scintillation unit was used on Ore B at Eldorado.

NEW PICKER UNIT

A new picker unit was constructed for these tests. It is capable of handling material up to 12 in., and can be operated either with one or more Geiger tubes located over the belt or with a scintillation head located under it. The ore was hand-fed to the far end of the belt, passed over the detector under the heavy lead shield and was directed into the concentrate or reject bin depending on the position of the grate plate. The belt was run at a speed of 22 ft./min. The scintillation unit was more or less conventional.



Circuit of the picker unit

TEST RESULTS

About 12½ tons of the Ore A material were screened on 3 in. and 1½ in. screens and the coarser fractions were treated separately on the belt. Two scintillation crystals were used as detectors, No. 1 of 1½ in. dia and 1-in. length, and No. 2 of 1½ in. dia. and 1½ in. length. The Geiger counter consisted of two Anton type 108 tubes connected in parallel and mounted 4 in. above the belt. Different runs differ mainly in the choice of discriminator setting—trigger control. The tests showed that the scintillation head worked efficiently and is capable of producing lower grade rejects. The 1½ in. fraction of the screened ore was not treated and was considered part of the combined product in which picker-belt concentrates would be included.

The picker assembly was transported to Eldorado and set up using the scintillation head only. It was used initially to treat a 10-ton sample of Ore B taken from the mine dump. In all cases the ore was hand-fed. In runs 8 to 13 the trigger was set to a position chosen as the best for that particular size by means of brief preliminary trials.

A second batch sample of Ore B, weighing about 14 tons, was also treated, but in a different way. The material was screened so as to give three fractions, namely +6 in., −6 in. +3 in., and −3 in. Only the +3 in. fractions were treated on the picker unit, in runs 11 to 13. The assays for the +6 in. and +3 in. fractions were calculated from the results of the picker test work. The −3 in. assay was the average of six 50 lb. grab samples. The +6 in. and +3 in. fractions were treated on the picker belt. It is felt that the ore contained more −3 in. material than would be encountered with run-of-mine ore and overall results should improve with, say, 50 per cent of the weight in the +3 in. sizes.

These test results can be summarized as showing that 94.2 per cent of the U_3O_8 in the +3 in. fractions of the mill ore could be recovered in 24.8 per cent of the weight at a grade of 0.103 per cent U_3O_8, and that 75-80 per cent of the U_3O_8 in all the +1½ in. fractions could be recovered by the Lapointe Picker in 25-30 per cent of the weight at a grade of 0.15-0.22 per cent U_3O_8.

CONCLUSIONS

In all, the results obtained in these tests are encouraging, considering the fact that it has not been possible to make a satisfactory pre-concentrate of these low-grade ores by gravity means.

Screening of the ore is most important. It was found indeed that, for an optimum recovery at a minimum loss, the sensitivity setting was critical enough to warrant closer screening. Washing the ore prior to treatment does not alter the results, unless a Geiger tube is used on the −2 in. +1 in. fraction.

MACHINERY AND EQUIPMENT

A New Screening Principle

The Symons V-Screen, produced by Nordberg Manufacturing Co., United States, is specifically designed for fine screening, for sizing, dewatering, dedusting, cleaning and washing. Recent modifications, described below, now make possible the separation of even finer particles than hitherto. The screen is unique in its construction and operating characteristics and is claimed to be the only screen that does not depend on gravity alone for its screening action.

An entirely new screening principle now gives the Symons V-Screen unequalled high capacity for sharp, single cut, wet or dry separations, especially in the more difficult to screen finer sizes. The screening principle employs controlled diffused feed and vertical flow of material, with a relatively low rotary speed and high speed gyratory action, combining centrifugal and gravitational force.

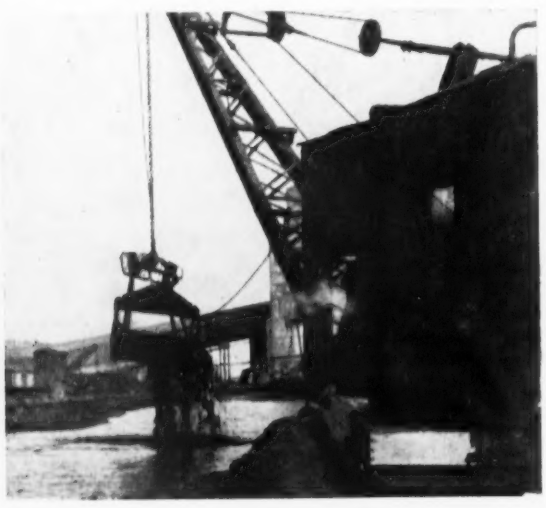
Material is fed by conventional methods to a vaned disc feed distributing plate located at the top of the screening drum and rotated in unison with the drum. The distributing plate disperses the material outward to the top of the inside of the screening cloth attached to the drum. The combination of the high speed gyration and drum rotation produces a separating force equal to about five times gravity, to pull the undersize through the apertures.

In addition to rotating at a constant speed, the drum gyrates through a ½-in. circular path 14 times for each revolution of the drum. Thus the material is subjected to about 1,000 pulsations a minute normal to the screening surface, and moves progressively downward. Through the frequently repeated intermittent contacts with the screening surface the material is sized and the oversize is carried in a spiral downward path around the drum to the bottom of the screening surface where it is discharged. The undersize, which has passed through the screening apertures, is also discharged at the bottom. Collection hoppers are incorporated as an integral part of the V-Screen base. The unit is described in Bulletin 243.

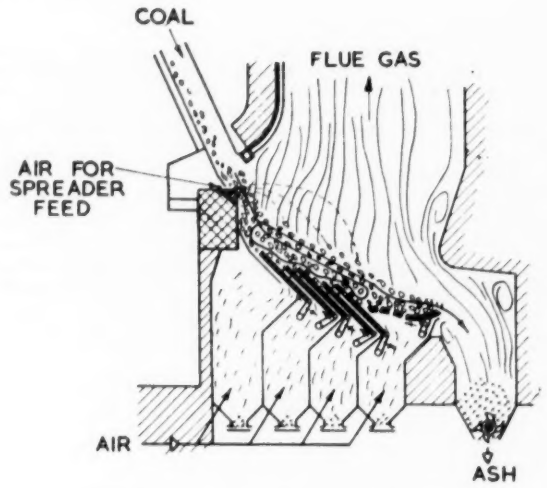
Burning Slurry on a Modern Stoker

The N.C.B. has successfully completed an experiment in burning low grade fuel which may result in considerable savings in cost and release better grade coal for the market. In this experiment, the Board has used a new type of mechanical stoker which is fully automatic, to burn slurry.

The amount of slurry collected in ponds increases steadily and it is estimated that about 6,000,000 tons lie in settling ponds at present. It is a wet and sticky fuel to handle and cannot be moved on rubber belts, scraper conveyors or bucket elevators, the most effective way to handle it being by a mechanical grab. Its ash and moisture content is high and although its calorific value at between 6,000 and 8,000 B.T.U.s a lb. is comparatively low, it could represent a useful source of fuel.



Collecting slurry from a settling pond for feeding into the Martin Stoker



Martin Stoker for fuels with high ash content

Known as the Martin Stoker, the new equipment is of German design and has been adapted and installed at Llay Main Colliery in North Wales. It has been consuming about 650 tons of slurry a week thus replacing the 450 tons of washed small coal previously used at this colliery to raise steam on watertube boilers fired by chain grate stokers and hand-fired Lancashire boilers. Savings of £1,000 a week have been achieved as a result of changing the fuel and the experiment at Llay Main indicates that raw slurry can be burned satisfactorily in a modern watertube boiler. Combustion is completely smokeless at all loads.

At Llay Main the fuel is taken from the pond by mechanical grab, loaded into wagons, transported over a weighbridge and transferred into a vertical-sided 60-ton bunker. At the base of the bunker are screw feeders with disintegrators mounted at the delivery end to break up the fuel before it passes down a wide feed chute. On entering the combustion chamber the fuel is sprayed on to the fire bed by air jets. The fire grate is inclined and incorporates reciprocating fire bars which agitate the fuel as it travels to the lower end to be discarded as ash, as slurry has a high moisture content which makes it difficult to spread.

A Two-Stage Portable Air Compressor

The portable Type ACD 105 air-cooled compressor, manufactured by The Lead Wool Co. Ltd., has a piston displacement of 135 cu. f.p.m. and an approximate actual delivery of 110 cu. f.p.m. F.A.D. The unit is fitted with the latest type AC 3 compressor.

This compressor is a two-stage twin-cylinder, vertical, air-cooled unit which delivers air at 1,200 r.p.m. Low pressure bore is $7\frac{5}{8}$ in. dia., high pressure bore $4\frac{1}{4}$ in. dia. and stroke $4\frac{3}{8}$ in. The cylinder block is high-grade nickel iron casting, accurately bored and well finned, while the cylinder head, a separate high-grade iron casting, gives easy access to the compressor valves. Forced lubrication to the main and big-end bearings is by oil pump mounted externally and positively driven from the crankshaft. The unit is driven by the Dorman 3LA engine, although alternatively the Petter B4 engine can be fitted.

METALS, MINERALS AND ALLOYS

COPPER.—The copper outlook continues to be dominated entirely by the labour problems of the American industry. As was anticipated last week the Butte, Montana, Mine-Mill union workers voted in favour of accepting Anaconda's wage offer ranging from 11½ to 17½ c. an hour. More than 80 per cent of the workers favoured acceptance. Subsequently Mine-Mill workers at Anaconda also accepted the terms, while other locals have yet to vote. The leisurely progress of voting is, of course, of no consequence because Anaconda's workings have not been struck. Anaconda can, indeed, congratulate itself on achieving a settlement without a stoppage. Mine-Mill workers have no cause to be dissatisfied. Many of them will receive less than the 15 c. which was considered the minimum objective because the steel workers had won that amount. Nevertheless the copper industry was one of the few to grant substantial wage increases last year when the American economy was believed to be entering a recession.

Negotiations are continuing between the union and Kennecott but there are no important developments to be reported between the union and Phelps Dodge or American Smelting and Refining, between which only local issues have so far been discussed. Indeed there is no evidence that the last two concerns have yet advanced beyond the 10 c. an hour originally offered.

Inevitably copper is in extremely tight supply and 46½ c. is reported to have been paid for July delivery while No. 2 scrap copper has risen to 36½ c. Small parcels of copper have been bought in Europe, and there is no foreseeable limit to these stringent conditions. A number of fabricators have been forced to close their plants; General Cable Corporation has closed six plants for a fortnight; Rome Cable Corporation is operating only three days a week for the rest of the month; other fabricators are tacking a week onto their vacation or starting their vacation shut down earlier than planned.

The American economy is now expected to continue at its present level of activity till at least the end of the year, while there is no reason to expect a let up in European copper demand. It is true that the housing boom is slowing down slightly because there is a general feeling that credit has been granted too easily for this purpose and is being curtailed. This should certainly ease copper demand a little. On the other hand, the automobile producers are continuing their almost incredible output (they take about 10 per cent of copper consumption). It is clear that the cutback in the third quarter—at least of the big three—will not be as big as was generally believed inevitable. Dealers are already receiving inducements to clear 1955 models and it is understood—though the producers are reluctant to say so—that 1956 models will be out in October, a month earlier than last year. Finally, there is the need to stock up at all stages of the copper producing, refining and fabricating industry.

Meanwhile, June crude copper production in the United States reached 102,760 tons against 106,733 in May; refined copper reached 131,431 tons against 135,042 tons. Outside the U.S.A. crude production in June was 142,098 against 135,306 tons in May. Refined copper output in June was 109,048 against 116,749 in May.

The official French import agency G.I.R.M. has raised the price of electrolytic copper paid by French consumers by Fr.5 to Frs.320 per kilo; the price had been stable since mid-June.

Reuter reports from Santiago that Anaconda Copper has asked the Chilean Government to raise the exchange rate for earnings on exports of Chilean ore; they are at present converted at 200 pesos to the dollar. It is also reported that a go slow is in operation at Chuquicamata's sulphide copper treating plant and this is slowing down mine output.

LEAD.—Lead has been a very strong market in the United States on the basis of 15 c. per lb. New York. The strength lies on the one hand in the keen demand by consumers and on the other in the strikes at the American Smelting and Refining plans as a result of which 12,000 tons of lead had already been lost by the beginning of this week. Those mines which are still working are understood to be working to capacity so that no relief can be expected from that source. There is still some unused refining capacity so that when the strikes are over supply should catch up with demand reasonably quickly. In the circumstances, it is not surprising that current offerings to the stockpile are exceedingly small.

TIN.—During the past week the Indonesian Government has scheduled a debate on the International Tin Agreement but there are no reports of its course; indeed (not surprising in Indonesia) it is not confirmed whether the plan was adhered to. There seems little doubt that the Indonesian Government does intend to ratify the agreement, but it is as well to remember, before counting an unhatched chicken, the prevailing conditions in the country. At any time the plan may be put aside in favour of the elementary tasks of simply maintaining law and order.

Fresh trouble may be in store in Singapore. The Singapore City Council Labour Union's Federation has decided to give 14 days' notice of a strike; if it were carried out the strike would disrupt all public services. Further, Mr. David Marshall has threatened his resignation following the Governor's refusal to appoint as many Ministers as Mr. Marshall required. For the time being, the row has blown over, but only until the Colonial Minister visits the city. Such unrest cannot but help to keep tin prices firm even if supplies from Malaya are not subject to actual dislocation.

Meanwhile in New York, tin has enjoyed steady and at times strong demand especially, it is understood, from small consumers. New York spot tin, which on July 14 was 96.87 had worked up by July 19 to 98.25 c. per lb. Tin can scarcely go much higher without a cry of gouging. In the circumstances, it is amusing to see that Mr. E. L. Bartlett, delegate from Alaska, has introduced a bill to establish a domestic tin buying programme. The bill would require G.S.A. to take delivery of not more than 10,000 l.tons of metallic tin in concentrates at suitable points of which Seattle (handy for Alaska) would be one. The base price would be $1.25 c. per lb. c.i.f. delivery point but there would be no upper limit to the buying price.

ZINC.—Zinc has been in good demand in the United States on a basis of 12.50 c. per lb. East St. Louis for prime western grades. Demand for special high grade continues, of course, to be well in excess of supply and business is being rejected simply because the metal is not there to satisfy it.

At the Bunker Hill and Sullivan Mining and Concentrating Co. in the Coeur d'Alene, the ballot on bargaining agents has gone in favour of the Mine-Mill union. The union is now taking up its wage claim which it had dropped pending the outcome of the ballot. It is feared that the union may shortly strike. Zinc producers have not so far been affected by the wave of strikes, but like the lead producers are currently making only small offerings to the stockpile because of the strength of commercial demand.

Howard I. Young, president of American Zinc Lead and Smelting Company, announced that his company had acquired leases on the Thompson and Temperly properties comprising 370 acres in South Wisconsin, where substantial tonnages of zinc ore have been proved. Development work was to be started in 30 days and it is expected that the mine will be producing by mid-summer 1956 at the rate of 12,000 tons a year of 60 per cent zinc concentrates.

American Smelting and Refining Company has announced an increase of a third in the electrolytic zinc plant capacity at Corpus Christi, Texas. The new facilities will be in operation before the end of 1956 and will increase the effective capacity to 9,000 s.tons a month.

ALUMINIUM.—The U.S. Bureau of Mines has now published provisional world production figures of bauxite for 1954. Including Iron Curtain countries, world production is estimated at 15,475,000 l.tons against 13,425,000 l.tons in 1953 and 8,050,000 tons in 1950. Output has thus practically doubled in four years. These kind of statistics make it clear that, with aluminium production expanding the way it is, the search for new bauxite deposits and research into alternative economic sources of alumina must be energetically pursued. All the main producing countries increased their output slightly last year while there were significant increases from Jamaica where exports rose to 1,998,144 tons against 1,203,208, and the U.S. where domestic production totalled 1,906,285 against 1,579,739.

COLUMBIUM.—The U.K. price of columbite continues to be more or less nominal at around £1,500-£1,600 per ton of contained metal. It is hardly surprising that buyers should be holding back at the moment pending some clarification of Washington intentions. Since the G.S.A. announcement made two months ago that the stockpile target of 15,000,000 lb. had been reached and the stockpiling was therefore ceasing, the Administration has put forward a Bill to provide for continued Government domestic buying of certain strategic metals—columbite among them—while at least one big American mining group has continued to show active interest in future production both in the States and abroad, a circumstance which has given some people to wonder whether the Bill might eventually turn out to authorize further purchases from foreign sources as well.

In any event, it is hardly likely that Washington would again make the mistake of offering so unnecessarily large a premium as in the past few years, and it may well be that no clear lead will come from the States until there is some better indication of what the "natural" world price level may be. In this connection, it has usually been assumed, during the period of American monopoly of the market, that there was a lot of potential European demand which would not make itself felt until prices became more normal. This demand will now presumably become effective substantially above the old £1,000 level but at exactly what price remains to be seen.

MAGNESIUM.—Although U.S. production of primary magnesium recovered in May from the exceptionally low April level caused by the stoppage at Dow Chemicals' Texas plant, it is clear that output this year is running substantially below last year, the figures for the first five months being 20,763 tons compared with 31,512 tons in the corresponding period a year ago. It is difficult to reconcile this trend with estimates made earlier this year of a probable increase in free world consumption of about 20 per cent. Moreover, as recently as last week the president of Dominion Magnesium is reported to have stated that Europe represented a growing market for Canadian production and that the output and sales of his company were running ahead of last year. Certainly it would be reasonable to look for increased utilisation of this metal now that various ceramic-type protective coatings have been developed which, it is understood, have largely solved the problems of corrosion which hitherto had been limiting the development of new uses.

NICKEL.—Continuing industrial expansion on both sides of the Atlantic is making the nickel supply position increasingly difficult. Certainly the diversion of an extra 1,000 tons (making 1,500 tons for the month) from the stockpile to U.S. industry in June has had little influence on the overall picture and the market has no doubt taken heed of the O.D.M.'s warning at the time of this additional release that such action should not be regarded as setting any kind of a precedent.

According to the *Metal Bulletin* prices for unallocated tonnages of nickel have gone as high as £1,500 per ton in Japan. The situation, however, is probably particularly acute there in view of the hold up in the supply of New Caledonian ores to Japanese smelters following the storm and flood damage of a few weeks ago. Meanwhile, of course, the official producer's price remains fixed at £519.

SILVER.—During the past week the New York silver price has again risen above parity with the Treasury's fixed purchase price for newly mined domestic silver. 90½ c. is enough to divert refined metal from the Eastern refineries to industrial users in other parts of the country, but the price is now 90¾ c. and it is thought that it may go as high at 91 c. The immediate cause of this increase is a continued strike (now nearly 3 weeks old) at the A.S. and R.'s refining and processing plants. This has cut off a major source of supply for U.S. industry and has upset what was already a tight market, due partly to expanding industrial demand, and partly to the present low level of stocks held by the Bank of Mexico, which is apparently preventing that organisation of effecting its traditional policy of stabilizing the New York market. These problems were discussed at length in our issue of May 27, page 584.

The London Metal Market

(From Our Metal Exchange Correspondent)

During the last seven days the copper market has been fairly active although the trend has been uncertain. The main factors in the situation have been the continued strike in America on the one hand and a substantial increase in U.K. warehouse stocks on the other, combined with the various opinions which have been expressed on possible results from the Geneva Conference.

The strike situation has remained shrouded in mystery with very little information being available, but it is clear that a number of fabricators had run their stocks down in recent months and are now in difficulties which has caused them either to pay top prices or suspend operations—this latter is an unpopular step, and it seems probable that the U.S. Government may intervene in some way to alleviate the situation. As forecast two weeks ago, the amount of copper reported in official warehouses in the U.K. has increased, and on Monday it exceeded 4,000 tons which was almost double that of the previous week.

In spite of this the backwardation has shown no signs of disappearing and did in fact increase, probably due to the high prices being paid in the U.S. for fairly prompt material. As during the immediate future there must be news of a settlement of the U.S. strike and some measure of agreement in Geneva, it is generally felt that copper prices will recede from their present high levels despite overall inflationary tendencies. It does seem, however, that the general price level for the remainder of the year is going to be on the upper side of £300 per ton and not below as was confidently expected three months ago.

The tin market has provided one of the features of the week with a sharp rise in the price level and an increase in the backwardation. This is attributed to good consumer demand and to a growing realisation that before the end of the year a surplus of production will not develop beyond the intake of the U.S. authorities. The American demand has been accentuated by smaller shipments from the Straits and a temporary dislocation in the flow of English tin caused by the recent dock strike. On Thursday morning the Eastern price was equivalent to £763⅜ per ton c.i.f. Europe.

Lead has remained a good market and growing demand has forced up the price since last week, and the world price level seems poised for a movement in the upper direction.

The zinc market has been disappointing, as, although some slight effort was made to follow the upward movement in copper and lead, the undertone has been uncertain in spite of favourable statistics. Whatever present sentiment, it is thought that in the long run the price level will move in an upward direction.

Closing prices and turnovers are given in the following table:—

	July 14		July 21	
	Buyers	*Sellers*	*Buyers*	*Sellers*
Copper				
Cash	£346	£347	£354	£354½
Three months	£339½	£340	£346½	£347
Settlement	£347		£354½	
Week's turnover	4,075 tons		3,625 tons	
Tin				
Cash	£744	£746	£766	£768
Three months	£739	£740	£758	£759
Settlement	£746		£768	
Week's turnover	780 tons		840 tons	
Lead				
Current half month	£105½	£105¾	£107½	£108
Three months	£105¾	£105½	£107	£107¼
Week's turnover	2,975 tons		2,825 tons	
Zinc				
Current half month	£91	£91¼	£91¼	£91½
Three months	£91	£91½	£91½	£91¾
Week's turnover	3,825 tons		4,075 tons	

OTHER LONDON PRICES — JULY 21

METALS

Aluminium, 99.5%, £171 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60% basis) 22s./24s. nom. per unit, c.i.f.
Bismuth
(min. 2 cwt. lots) 16s. lb.
Cadmium (Empire) nominal
Chromium, 6s. 11d./7s. 4d. lb.
Cobalt, 21s. lb.
Gold, 251s. 9½d.
Iridium, £30 oz. nom.
Manganese Metal (96%-98%) £269 according to quantity
Magnesium, 2s. 4d. lb.
Nickel, 99.5% (home trade £519 per ton
Osmium, £24/27 oz. nom.
Osmiridium, £40 oz. nom.
Palladium, £7 0s./£7 10s. oz.
Platinum U.K. and Empire Refined £29 oz. Imported £30/31 oz.
Rhodium, £40
Ruthenium, £16 oz.
Quicksilver, £108 ex-warehouse
Selenium, 43s. nom. per lb.
Silver, 79d. f.oz. spot and 78½d. f'd
Tellurium, 15s./16s. lb

ORES, ALLOYS, ETC.

Bismuth .. .. 65% 8s. 6d. lb. c.i.f. 50% 7s. 3d. lb. c.i.f.
Chrome Ore—
Rhodesian Metallurgical (semi-friable) 48% £13 per ton c.i.f.
,, Refractory 45% .. £13 per ton c.i.f.
,, Smalls 42% .. £10 2s. 6d. per ton c.i.f.
Magnesite, ground calcined .. £26-£27 d/d
Magnesite, Raw .. .. £10-£11 d/d
Molybdenite (85% basis) .. 105s. 3d.-108s. 1d. per unit c.i.f.
Wolfram and Scheelite (65%) .. 250s./255s. c.i.f.
Tungsten Metal Powder (98% Min. W.) .. 20s. 2d. nom. per lb. (home)
Ferro-tungsten (80%-85%) .. 17s. 2d. nom. per lb. (home)
Carbide, 4-cwt. lots .. .. £37 6s. 3d. d/d per ton
Ferro-manganese, home .. £53 17s. 6d. per ton
Manganese Ore Indian c.i.f. Europe (46%-48%) .. .. 70d./73d. per unit
Manganese Ore (38%-40%) .. 46d./51d. per unit
Brass Wire .. .. 3s. 3½d. per lb. basis
Brass Tubes, solid drawn .. 2s. 8½d. per lb. basis

THE MINING MARKETS

(By Our Stock Exchange Correspondent)

With the notable exception of British funds, which have been hit by talk of the possibility of the Bank Rate being put up again coupled with currency uncertainties, the stock markets during the past week have again been giving a good account of themselves. The fresh burst of inflation conoted by the latest rise in the retail price index has triggered off a new upward movement in equities and, helped by the statistical outlook, commodity issues have often been going further ahead.

After being as depressed as ever at the start of the week Kaffirs have shown a quite notable revival. It cannot be said that the latest quarterly reports have been the mainspring here, but rather that continuing talk about the future of sterling, coupled with remarks which have been made concerning the gold price by Mr. Louw, the South African Finance Minister, have stimulated the hope that some of the low-graders particularly offered speculative scope at the low levels to which they had fallen.

Anyway, it appears that this view has been shared by Continental operators who have been returning to their favourite dividend payers in the Kaffir market on a more than tentative scale. Thus, there has been a general advance in such shares as Brakpan, Robinson Deep, the Geduld, Grootvlei and so on.

Nor has the movement stopped at these low-grade producers. In so far as the developing mines are concerned, Hartebeestfontein have recovered their poise considerably in face of the June quarterly report disclosing a fall in development values to 458 in. dwt. against 516 in. dwt. in the March quarter. Payability, on the other hand, has remained extremely satisfactory at 96 per cent and the market evidently is attaching more importance for the moment to the first monthly return due at the beginning of August.

Among the General Mining Group quarterlies there was nothing exceptionally stimulating. Values at Ellaton held up at around 348 in. dwt., but there was a fresh drop to 51 per cent, against 72 per cent, in payability. Stilfontein's values and payability were both lower than in the March quarter.

Consolidated African Selection have been exceptionally strong among Diamonds, the belief evidently being held that something of a favourable nature for the company's subsidiary might emerge from the Sierra Leone diamond talks now proceeding in London. It is thought that the talks might reach a conclusion next week.

Coppers have been mainly rather quieter than before though remaining firm enough with the fresh rise in the metal price. Chartered and Rhokana, however, have both been finding considerable investment support and among the others a new and substantial advance in Messina shares and options have been followed by only a partial reaction.

With the further rise in the price of the metal to the highest for more than a year there has been a sustained revival in tin shares, attention being mainly directed towards the Malayans which have been showing good production records during the past year.

Lead-zinc issues have also been showing up well with Mount Isa being especially prominent helped by the wider realization of the fact that the company is now a big producer of copper as well as lead and zinc.

Consolidated Murchison, the antimony producer, has reported June quarter profits of £240,000, against £275,000, a result which was considered satisfactory enough to lift the shares modestly.

Oil shares, which had been strong all the week, again went ahead fast yesterday morning following the statement by the Minister of Fuel and Power in the Commons on Wednesday which foreshadowed an expanded substitution of oil for coal, equivalent to an additional saving of 25,000,000 tons of coal per year by 1960.

Finance	Price July 20	+ or — on week
African & European	3⅞	—⅛
Anglo American Corpn.	8⅝	—⅛
Anglo-French	22/9	+3d
Anglo Transvaal Consol.	26/3	—1/3
Central Mining (£1 shrs.)	46/9	—3d
Consolidated Goldfields	64/3	+1/1½
Consol. Mines Selection	40/7½	
East Rand Consols	2/1½	
General Mining	5	—⅛
H.E. Prop.	9/4½xc	—1/1½
Johnnies	39/9	—9d
Rand Mines	3¼	—⅛
Rand Selection	43/9	—7½d
Union Corporation	43/9	
Vereeniging Estates	4⅛	+⅛
Writs	41/10½	
West Wits	38/3	—3d
Rand Gold		
Blyvoors	27/6	
Brakpan	6/6	+1/-
Buffelsfontein	38/-	+6d
City Deep	11/6	+6d
Consol. Main Reef	21/3	+2/3
Crown	2¼	+⅛
Daggas	2½	
Dominion Reefs	35/6	+1/-
Doornfontein	26/3	
Durban Deep	29/4½	+7½d
E. Champs	6/-	
E. Daggas	9/3	+6d
E. Geduld (4s. units)	29/9	+6d
E. Rand Props.	3	—⅛
Geduld	4⅛	
Govt. Areas	6/-	+6d
Grootvlei	20/3	+3d
Hartebeestfontein	38/3	+3d
Libanon	8/3	+3d
Luipaards Vlei	19/9	—3d
Marievale	20/-	
New Kleinfontein	6/-	+6d
New Pioneer	13/9	—3d
Randfontein	55/3	—9d
Robinson Deep	15/-	
Rose Deep	10/-	
Simmer & Jack	3/6	
S.A. Lands	22/6	+7½d
Springs	2/4½	+4½d
Stilfontein	26/3	—3d
Sub Nigel	36/3	+7½d
Vaal Reefs	34/3	—1/9
Van Dyk	3/3	
Venterspost	13/3	+3d
Vlakfontein	17/-	+6d
Vogelstruisbult	30/6	+6d
West Driefontein	5¼	
W. Rand Consolidated	43/1½	
Western Reefs	36/3	—1/3
O.F.S. Gold		
Freddies	4/6	+3d
Freddies Consolidated	6/4½	+1½d
F.S. Geduld	4⅛	—⅛
Geoffries	15/9	—1/-
Harmony	33/6	+3d
Loraine	9/3	—7½d
Lydenburg Estates	18/9xc	—1/10½
Merriespruit	10/-	—3d
Middle Wits	15/3xc	—4/3
Ofsits	65/3	—1/7½
President Brand	69/9	—3d
President Steyn	38/3	—1/3
St. Helena	30/3	—1/-
Virginia Ord.	13/-	—9d
Welkom	20/3	—1/3
Western Holdings	3⅝	—⅛
West African Gold		
Amalgamated Banket	2/1½	+1½d
Ariston	6/3	
Ashanti	23/4½	—1½d
Bibiani	4/6	—1½d
Bremang	1/6	+1½d
G.C. Main Reef	3/1½	—1½d
Konongo	3/1½	+3d
Lyndhurst Deep	1/6	+1½d
Marlu	1/4½	
Taquah	2/3	—1½d
Western Selection	9/9	
Australian Gold		
Gold Mines of Kalgoorlie	13/3	
Great Boulder Prop	10/7½	—1½d
Lake View & Star	18/6	—6d
Mount Morgan	22/3	—3d
North Kalgurli	7/1½	
Sons of Gwalia	4/6	—9d
Western Mining	9/6xd	+3d
Miscellaneous Gold		
Cam & Motor	8/9	
Champion Reef	4/1½	+1½d
Falcon Mines	6/9	
Globe & Phoenix	24/6	
G.F. Rhodesian	6/6	
Motapa	1/1½	
Mysore	4/3	—1½d
Nundydroog	6/7½	
Oregum	4/3	
St. John d'El Rey	19/4½xd	+5/4½
Zams	59/4½	+1/3

Diamonds and Platinum	Price July 20	+ or — on week
Anglo American Inv.	9¼	
Casts	24/6	—3d
Cons. Diam. of S.W.A.	7	
De Beers Defd. Bearer	6¼	+⅛
De Beers Pfd. Bearer	15¼	
Pots Platinum	10/-	+3d
Waterval	16/3	+9d
Copper		
Bancroft	41/3	—3d
Chartered	74/3	+6/10½
Esperanza	4/3	
Messina	9⅛	+⅛
Nchanga	14¼	+⅛
Rhod. Anglo-American	5⅛	+⅛
Rhod. Katanga	23/6	—3d
Rhodesian Selection	44/7½	—1/3
Rhokana	42¼	+¼
Rio Tinto	3⅞	—⅛
Roan Antelope	26/9	—1½d
Selection Trust	4⅛	
Tanks	8⅛	+⅛
Tharsis Sulphur Br.	7⅛	—⅛
Tin (Eastern)		
Ayer Hitam	33/-	+6d
Gopeng	11/3	+2/1½
Hongkong	8/6	—3d
Ipoh	24/-	
Kamunting	9/6	+1/9
Kepong Dredging	3/6	+6d
Kinta Tin Mines	16/-	+1/9
Malayan Dredging	10/3	+9d
Pahang	15/-	+2/6
Pengkalen	13/6	+1/6
Petaling	10/9	+9d
Rambutan	19/3	
Siamese Tin	8/6	+10½
Southern Kinta	19/6	+10½d
S. Malayan	8/7½	+1/1½
S. Tronoh	9/3	+1½d
Sungei Kinta	13/3	+1½d
Tekka Taiping	9/6	+2/3
Tronoh	9/4½	+9d
Tin (Nigerian and Miscellaneous)		
Amalgamated Tin	14/1½	+7½
Beralt Tin	34/-	—6d
Bisichi	8/3	+10½d
British Tin Inv.	27/-xd	+2/3
Ex-Lands Nigeria	2/10½	+1½d
Geevor Tin	14/3	+9d

Tin (Nigerian and Miscellaneous) contd.	Price July 20	+ or — on week
Gold & Base Metal	2/3	
Jantar Nigeria	7/-	+7½d
Jos Tin Area	14/6	+6d
Kaduna Prospectors	2/1½xd	
Kaduna Syndicate	2/9xd	
London Tin	9/6	+3d
United Tin	2/-	+1½d
Silver, Lead, Zinc		
Broken Hill South	54/3xd	—3d
Burma Mines	3/3	
Consol. Zinc	58/9	+9d
Lake George	12/3	—3d
Mount Isa	62/6xd	+4/-
New Broken Hill	44/-xd	+2/3
North Broken Hill	76/10½	+7½d
Rhodesian Broken Hill	14/7½	+4½d
San Francisco Mines	23/-	—3d
Uruwira	7/9	
Miscellaneous Base Metals and Coal		
Amal. Collieries of S.A.	49/-	
Associated Manganese	33/6	—6d
Cape Asbestos	11/7½	—1½d
C.P. Manganese	36/6	+6d
Consol. Murchison	56/10½	—1/10½
Natal Navigation	2½	
Turner & Newall	117/-	+2/6
Wankie	18/7½	—3d
Witbank Colliery	4	
Canadian Mines		
Dome	$30	
Hollinger	$41½	—1¼
Hudson Bay Mining	$116½	+½
International Nickel	$132½	—½
MiningCorpn.ofCanada	£8½	
Noranda	$105	—1½
Quemont	£9¼	
Yukon	4/6	
Oil		
British Petroleum	6¼	+¼
Apex	35/3	+3/9
Attock	48/-	+1/9
Burmah	9¼	+1⅛
Canadian Eagle	66/-	+5/9
Mexican Eagle	23/-	+6d
Shell	7⅛	+¼
Trinidad Leasehold	44/-	+6/9
T.P.D.	27/-	+9d
Ultramar	33/-	+2/6

COMPANY NEWS AND VIEWS

Further Rand and O.F.S. June Quarterlies

Quarterly reports in respect of the three months ended June 30 from the General Mining, Johannesburg Consolidated, and Anglo-Transvaal Groups have been published since last week's issue of *The Mining Journal* in which those from the Anglo American and Union Corporation Groups appeared. On the whole the returns have done little to change the general lack of enthusiasm which has been characteristic of the Kaffir market for many months past. At all events, there was little enough in the latest batch calculated to arouse much interest.

Most notable amongst the General Mining quarterlies was that from Stilfontein. A decline in gold content has for some time been apparent at this property and the present report shows that values during the past three months fell to 265 in. dwt. from 315 in. dwt. previously, bringing the average of the past six months down to somewhere in the region of 300 in. dwt. This compares with 374 in. dwt. over the previous twelve months. At Ellaton values improved to 348 in. dwt. from 338 in. dwt. previously but payability fell away sharply to 51 per cent from 72 per cent. As uranium figures in respect of these two companies are not published monthly particular interest attaches to quarterly earnings from this source. In the case of Ellaton uranium brought in £27,550 before allowing for capital and interest payments which amounted to £14,286. Against this, however, was £11,225 in respect of amortization contributions received from other participants in the uranium scheme. Stilfontein's uranium profits were £105,374 before loan and interest payments of £108,154. Amortization contributions received amounted to £60,663.

It had been announced last week that the Vaal Reef had been intersected in Buffelsfontein's ventilation shaft at a depth of 4,496 ft. disclosing a value of 314 in. dwt., and while recent market rumour had suggested the presence of khaki shale on the property, no reference to this was made in the quarterly return. Indeed, as ground conditions on the Far West Rand as a whole have been good, it would not appear wise to place too much importance on such a possibility.

The Johannesburg Consolidated quarterly contained the interesting disclosure that Freddies Consolidated had disposed of 65,000 Free State Geduld shares by June 30. The transaction brought in £287,137. No improvement was apparent from development results at the property which revealed average values of 305 in. dwt. as against 320 in. dwt. during the preceding quarter. On the other hand payability improved considerably to 73 per cent from 64 per cent. From Randfontein came the encouraging report that net revenue from uranium and acid during the quarter had risen to £916,000 from £797,000. Yet the total profit increased only modestly to £282,773 from £265,442 due to a greater loss on gold operations.

Amongst the reports from the Anglo-Transvaal Group that from Hartebeestfontein was disappointing. At this property from which a maiden production report is expected at the end of the current month, very much better values were obtained from initial development operations than were indicated by the original drilling programme. So far, the first six months of development had disclosed values averaging something in the region of 550 in. dwt. The present report shows a considerable decline from this figure at 458 in. dwt. which compares with 516 in. dwt during the previous quarter. At Merriespruit also, values declined to 363 in. dwt. from 487 in. dwt. but Virginia's values recovered to 346 in. dwt. from 318 in. dwt.

Gold and Base Maintains 7½ Per Cent

Production of columbite by Gold and Base Metal Mines of Nigeria during the year ended December 31, 1954, exceeded by 10 s.tons the original target set for this mineral, and the total of 150 s.tons achieved compares with 93 s.tons during the previous year. This more than counteracted the fall in tin output to 510 l.tons from 550 l.tons with the result that the gross revenue earned moved up sharply.

Year to Dec. 31	*Total* Revenue*	*Taxation*	*Net† Profit*	*Dividend*	*To Reserve*	*Carry Forward*
	£	£	£	£	£	£
1954	589,315	8,000	40,319	25,875	20,000	58,535
1953	476,085	10,000	31,443	24,750	Nil	48,549

* Including tin revenue £268,212 (£267,915). Columbite £319,913 (£207,705).
† After expenses including Nigerian expenditure £282,999 (£276,198); Realisation charges and Royalty £118,044 (£96,391); Depreciation £62,756 (£23,063); Development and Prospecting expenditure £39,065 (£12,768); Interest £21,993 (£9,744).

Distribution on the issued ordinary capital of £600,000 in stock units of 2s. 6d. was maintained at 7½ per cent.

During the first six months of the current financial year output of columbite has risen to 82½ s.tons as compared with 53½ s.tons during the previous corresponding period. This encouraging result suggests no reason why the ultimate figure of at least 200 s.tons of columbite should not be reached during the full twelve months. The production level of tin has also been favourable, output having moved up to 266 l.tons from 231 l.tons during the previous corresponding period.

Although a full assessment of the company's future prospects must await the publication of the report and accounts next month, it is possible to look for substantially increased earnings in respect of the current financial year. Nevertheless, it must be borne in mind that current capital and depreciation expenses are still considerable, besides which provision has to be made for the repayment (by way of columbite produced) of outstanding U.S. loans.

The yield on Gold and Base 2s. 6d. ordinary shares at the present price of about 2s. 3d. is no more than 8 per cent, and it appears that the market may have given too little consideration to financial commitments which could easily limit near-term distributions. Major General W. W. Richards is chairman.

Kent (F.M.S.) Treats Lower Grade Ground

A substantially lower recovery at .51 lb. per cu. yd. as compared with .59 lb during the previous year resulted from Kent (F.M.S.) Tin Dredging's operations during the twelve months ended December 31, 1954. As the price of tin remained largely unchanged from the preceding year's level, added to which costs declined, the lower profits were directly due to lower output.

Year to Dec. 31	*Area Dredged (acres)*	*Treated cu. yds. (000)*	*Per cubic yard Yield (lb.)*	*Per cubic yard Cost (d.)*	*Output in tons (conc.)*	*Price rec'd per ton (£)*
1954	14.45	1,582.3	0.51	13.8	359.3	413
1953	14.35	1,601.4	0.59	14.1	414.7	427

Dividends on the issued ordinary capital of £105,000 in 2s. shares were reduced from 50 per cent to 40 per cent.

Year to Dec. 31	*Total Revenue*	*Taxation*	*Net* Profit*	*Dividends*	*To Reserve*	*Carry* Forward*
	£	£	£	£	£	£
1954	185,454	33,916	18,986	23,494	Nil	33,350
1953	221,560	34,375	46,395	28,875	15,000	33,608

* After £11,586 written off capital expenditure. (1953 - £517).

Due to a somewhat reduced output being expected during the current financial year owing to a lower average value of ground and the higher proportion of clay known to be present, the outlook is somewhat uncertain. So far, six months operations have resulted in the recovery of 140 tons of tin ore which represents a drop of over 43 tons from the 183¾ tons recovered during the previous corresponding period. It certainly appears that unless during the coming six months the grade moves up to levels approximating to that of past years the present financial year's profit will suffer a sharp contraction.

An expression of current doubts regarding maintenance of the past year's 40 per cent dividend may be found in the exceptionally high return of nearly 23 per cent obtainable on the company's ordinary 2s. shares now standing in the region of 3s. 3d. Mr. W. E. Hosking is chairman. Meeting, Redruth, Cornwall, July 27.

Ex Lands Maintains 20 Per Cent

Ex Lands Nigeria, the West African tin property, has maintained its distribution for the year ended December 31, 1954, at 20 per cent on the ordinary capital of £270,128 in stock units of 2s. Total profit for the year before taxation of £33,543 (£25,250) advanced to £59,995 from £48,545. Dividends absorbed £31,522 (£29,714) and the carry forward was £40,706 as compared with £45,776. At their present price of around 2s. 10d. Ex Lands 2s. ordinary stock units stand to yield nearly 13½ per cent. During the first six months of the current financial year 319 tons of tin ore have been produced as against 325 tons in the previous corresponding period.

Major General W. W. Richards is chairman. The meeting will be held in London about the middle of August.

FOR SALE: GENERAL. Quantity of $\frac{7}{8}$ in. Hexagon Steel, suitable for rock drills, 26 ft. 6 in. long, with small hole through centre. Apply M. Bloomfield and Sons. Telephone: Debenham 353/4.

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Further particulars and application form will be sent by the undersigned on receipt of a stamped addressed foolscap envelope. Last date for receipt of applications: Friday, August 19, 1955. Applications not on the form provided will be disregarded.

(Signed),
E. C. SMITH, *Principal.*

July 13, 1955.

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Company Shorts

Mountain Copper Earns Less, Pays More.—During the year ended December 31, 1954, group net profits after tax, earned by the Mountain Copper Company, fell sharply to £77,763 from £123,524. Besides being due to a decline of some 10½ per cent in trading profits, this drop resulted from heavy depreciation and other changes which absorbed the unusually heavy amount of £138,874 (£115,663). After the payment of 37½ per cent (33½ per cent) on the issued ordinary capital of £200,000 in shares of 2s. as increased from the previous year's level of £150,000, no transfer was made to general reserve (£278,117). The balance carried forward accordingly rose to £171,632 from £121,152. Mr. R. E. Binns is chairman. Meeting, London, July 28.

San Francisco Mines Mill Record Tonnage.—A record mill throughput amounting to 738,800 tonnes, an increase of 45,600 tonnes over the previous year's level, was achieved by San Francisco Mines of Mexico during the year ended September 30, 1954. Partly as a result of this increased activity, and partly due to the higher grade of ore milled, output of concentrates reached the record tonnage of 147,596 tonnes, as compared with 121,545 tonnes during the previous year.

Total revenue earned accordingly rose markedly to £8,322,527 from £6,632,454. After mining and milling expenses, allowances for the value of opening and closing stocks of concentrates and smelting, refining and marketing costs, including Mexican taxes of £1,864,565 (£1,391,325), net profits showed a modest increase to £294,622 (£255,119). Dividends amounting to 3s. per unit, including a bonus of 1s. (3s. plus bonus of 2s.), absorbed £354,800 (£452,498) and the balance carried forward advanced to £293,895 from £382,820. Mr. C. E. Temperley is chairman. Meeting, London, July 22.

Commission Payment Boosts London Australian's Revenue.—Total revenue earned by the London Australian and Exploration Company during the year ended April 30, 1955, advanced to £21,775 from £14,258. The sharp increase was due mainly to a payment of over £6,000 representing commission due from Central European Mines to which company London and Australian acts as selling agents. This first instalment moneys due was made possible by the receipt of compensation claims received from the Yugoslavian government. After expenses, net profits rose to £15,264 from £10,145. An amount of £7,900 was written off capital expenditure and dividends absorbed £8,687 (nil). The balance carried forward was £5,270 (£5,309).

Decline in Tehidy's Profits.—Lower receipts from dividends and interest at £7,049 as compared with £9,581 were responsible for a decline to £16,041 from £18,460 in the total revenue earned by Tehidy Minerals during the year ended December 31, 1954. Mineral dues and rents provided the virtually unchanged income of £8,984 as against £8,867. After provision for dividends which absorbed £6,247 (£6,064) the balance carried forward was slightly lower at £17,403 as compared with £17,965. The company's balance sheet disclosed an exceptionally strong liquid position and as at December 31, 1954, net liquid assets amounted to some £86,000. Quoted investments shown at £72,585 representing holdings in British Government and other securities and Malayan Tin Companies—had a market value of £79,671. Mr. D. W. Thomas is chairman. Meeting, Camborne, Cornwall, July 23.

Ampat Tin's Profits Slightly Decreased.—A total production of 1,236 tons of tin concentrates compared with 1,266 tons previously by Ampat Tin Dredging during the year ended December 31, 1954, brought in £666,274 as against £679,852 during the preceding twelve months. After taxation of £98,000 (£80,000) net profits moved up to £68,913 from £63,795. Dividends of 42½ per cent (35 per cent) on the issued ordinary capital of £250,000 in 4s. shares absorbed £60,156 as against £48,125 and the unappropriated balance carried forward rose to £95,233 from £86,476. Mr. J. Ivan Spens is chairman.

Charterland and General Earns More.—Total revenue earned by Charterland and General during the year ended May 31, 1955, rose to £144,983 from £117, 878. After taxation of £71,926 (£47,851) net profits were £61,497 (£59,258). Dividends absorbed £46,588 (£37,745) and an amount of £15,000 (£20,000) was transferred to general reserve. The balance carried forward declined slightly to £11,351 from £11,442. Quoted investments shown on the balance sheet at £845,008 had a market valuation of £1,258,459 as at May 31. The portfolio includes a selection of mining shares. Mr. J. E. W. Lomas is chairman and managing director. Meeting, London, July 22.

Reduction in Phoenix Prince's Capital.—The issued capital of Phoenix Prince Gold Mining Company is to be reduced from £500,000 divided into 2,000,000 shares of 5s. each to £300,000 divided into 2,000,000 shares of 3s. each by returning 2s. per share.

During the year ended March 31, 1955, the company made net profits of £31,360 (£37,861) before providing for taxation of £12,860 as compared with £33,598. An amount of £10,000 (nil) was transferred to general reserve and the balance carried forward remained virtually unchanged at £12,822 as against £12,809. Mr. Aexander Macquisten is chairman. Meeting, London, July 28.

Nigerian Consolidated's Higher Profits.—A sharp increase in net profits was achieved by Nigerian Consolidated Mines to £6,538 from £3,408 during the year ended March 31, 1955. Dividends of 7½ per cent (5 per cent) absorbed £2,931 (£1,925) and the unappropriated profit carried forward to the balance sheet moved up to £12,431 (£11,439). The company's quoted securities—of which mining and finance shares make up 42 per cent—were shown in the balance sheet at £96,345 on March 31 last. This compared with a market valuation of £124, 148.

Obituary

MR. ALGERNON GORDON DOYLE

Mr. Algernon Gordon Doyle, one of the discoverers of the Geita Gold field and a foundation member of the Tanganyikan firm of consulting mining geologists and engineers, the East African Mining and Development Co., Ltd., died at his home in London on May 18.

Mr. Doyle graduated from the School of Metalliferous Mining, Camborne, in 1912, and spent the next two years working on the Rand before joining the Royal Engineers in which he served with distinction and was awarded the M.C. Mr. Doyle was elected an Associate Member of the Institution of Mining and Metallurgy in 1933, and held several directorships of mining companies.

Gold Mine Returns

AUSTRALIAN GOLD

Company	4 weeks to May 17 1955		4 weekly period since year-end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Central Norseman	12·6	6,937	2	24·8	13,866	23·9	12,225
Central Victoria*	84·0	343	2	167·5	691	420·4	1,408
G.M.'s of Kalgoorlie‡	37·7	9,200	2	72·4	18,329	†	
Gt. Boulder§	102·2	25,564	6	210·4	50,466	211·3	49,120
Morning Star	1·5	447	2	2·9	1,278	2·7	2,481
New Coolgardie	5·2	2,111	2	9·2	3,775	9·1	4,653
Sons of Gwalia	10·0	2,431	5	46·5	10,148	38·5	8,095

* Cu. yds. dredged.
† Last year's figures not comparable.
‡ Boulder Perseverance, Kalgoorlie Enterprise and South Kalgurli Cons. included in these returns.
§ Quarterly, to 17 May.

INDIAN GOLD

Company	May, 1955		Months since year end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Champion Reef	16·6	5,988	5	73·3	26,326	73·3	27,952
Mysore	16·3	5,060	5	77·7	24,527	87·3	33,677
Nundydroog*	17·4	6,936	5	88·6	26,562	105·3	29,551

* Includes tailings

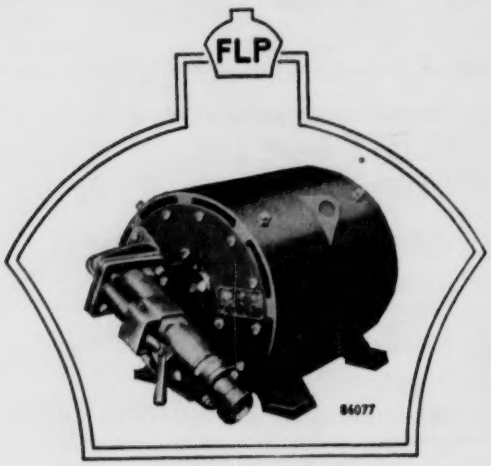
MISCELLANEOUS GOLD

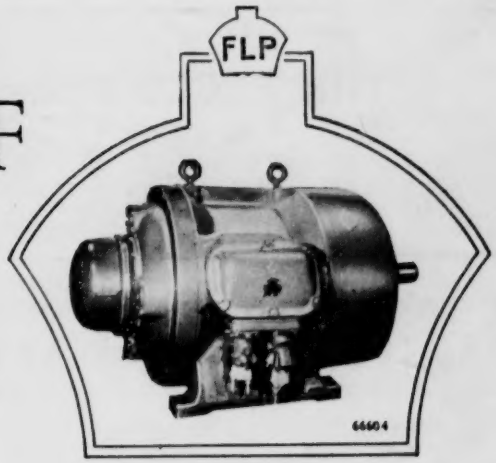
Company	May 1955		Months since year-end	Current Financial Year Total to date		Last Financial Year Total to date	
	Tons (000)	Yield (oz.)		Tons (000)	Yield (oz.)	Tons (000)	Yield (oz.)
Br. Gv. Consol.*	150·3	1,568	5	829·6	7,043	946·0	9,177
Clutha River*	237·0	421	2	421·0	785	459·0	631
Frontino	11·6	7,025	5	58·2	31,257	50·4	28,915
Kentan (Geita)	24·6	3,291	11	249·5	37,637	234·0	35,520
New Gu. Gldfds.	3·5	1,575	8	27·8	11,205	26·0	11,434
St. John d'El Rey	8·8	40·0	5	119·1	504	129·9	588·9

* Cu. yd. dredged

Metal and Mineral Trades

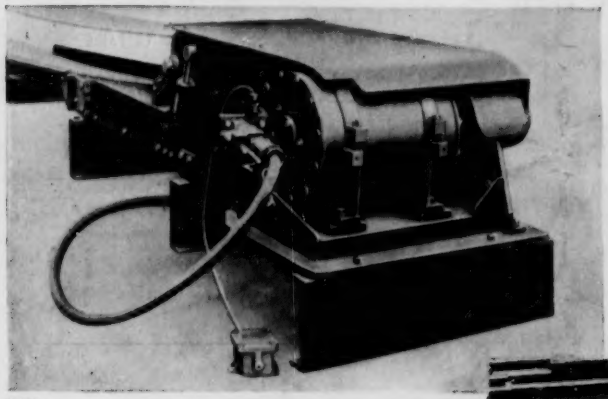
FLAMEPROOF





Top Left: *Totally-enclosed fan-cooled flameproof squirrel-cage motor, type KF.*
Top Right: *T.E.F.C. flameproof slipring motor, type FW.*

Metrovick Motors for Mines



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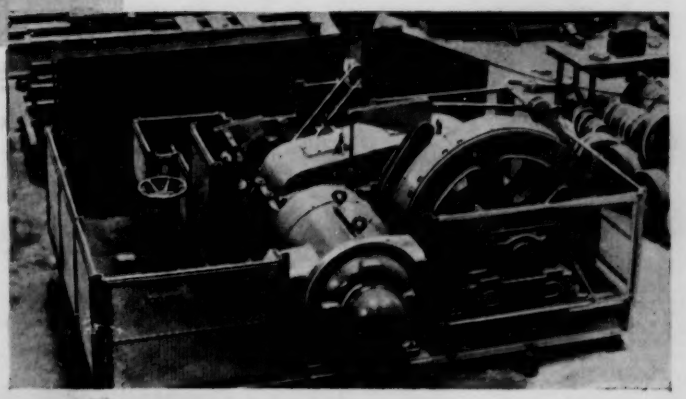
Flameproof squirrel cage and slipring motors are made by Metrovick up to 1000 hp at 1500 rpm for mining applications where inflammable gases are encountered. A complete range of non-flameproof motors is available for miscellanous services. Write for full details.

Above: *Type KF flameproof motor driving a "Huwood" conveyor.*
Right: *125 hp, 580 rpm totally-enclosed, fan-cooled, flameproof Metrovick slipring induction motor driving Beckett and Anderson "Man-Riding" haulage for a colliery. Electro-hydraulic thrustor operating main brake is seen on left of motor.*



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